Remarks

In view of the above amendments and the following remarks, favorable reconsideration of the outstanding office action is respectfully requested.

Attached hereto is a page entitled "Version with Markings to Show Changes Made."

Previously, claims 1-41 were in the application. As now amended, claims 1-7, 9-11, 13-22 and 24-42 remain in this application. Claims 1, 3, 9, 13-15, 19-22 and 24-25 have been amended herein. Claims 8, 12 and 23 have been cancelled herein. New claim 42 has been added.

1. Drawings

Examiner is thanked for the indication in the accompanying form PTO-326 that the formal drawings previously submitted have been accepted.

2. Allowed Claims/Subject Matter

Applicant notes with appreciation the Examiner's allowance of claims 26-41, and further that the Examiner has indicated the subject matter of claims 3, 4, 13-19, 24, and 25 are patentable and would be allowable if rewritten in independent form.

3. Claim Objections

The Examiner has objected to claims 1, 19 and 25. Examiner has suggested the insertion of "that" after --profile—in claim 1. Claim 1 has been amended to include that insertion as suggested by Examiner. Claim 19 has been amended to delete the reference to the outer cladding. Claim 25 has been amended to remove the contradicting gutter language. Accordingly, the Applicant's attorney believes that the objections to claims 1, 19 and 25 have been overcome. Further, claims 19 has been rewritten in independent form including all the limitations of claims 1. As such, claims 19 is now allowable.

4. § 112 Rejections

The Examiner has rejected claims 20-22 under 35 U.S.C. § 112, first paragraph, as being indefinite for failing to particularly point out or distinctly claim the invention. In particular, the Examiner asserts that the disclosure lacks a written description supporting the claimed ranges for the relative refractive index of the outer clad.

The Examiner has rejected claims 20-22 and 25 under 35 U.S.C. § 112, second paragraph, as being indefinite for claiming a positive relative refractive index percent for the

gutter segment while the specification discloses negative relative refractive index percents for the gutter segments.

To overcome the 112 rejections, claims 20-22 have been amended to delete all references to the cladding Δ%. Additionally, claim 20-22 and 25 have been amended to add the correct negative Δ% ranges for the gutter (support for the amendments is found on Page 16, Para. 49). Accordingly claims 20-22 and 25 are now allowable.

5. §102 Rejections

Claims 1, 2, 5-11 and 23 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Publication No. 2002/0154877 (the Li et al. application).

The Examiner asserts that Li teaches a dispersion and dispersion slope compensating optical fiber 24 comprising a segmented core and a cladding layer and that the fiber exhibits a refractive index profile that is selected to provide a dispersion having a miximum deviation of less than about 5 ps/nm-km within the wavelength band of from about 1550 nm to about 1610 nm. The linearity is based upon Fig. 9 of the Li et al. application.

The Examiner has also rejected claims 1, 2, 12 and 23 under 35 U.S.C. § 102(e) as being anticipated by U.S. Publication No. 2002/0028051 (the Bickham et al. application). The Examiner asserts that Bickham teaches a dispersion and dispersion slope compensating optical fiber 24 comprising a segmented core and a cladding layer and that the fiber exhibits a refractive index profile that is selected to provide a dispersion having a maximum deviation of less than about 5 ps/nm-km within the wavelength band of from about 1550 nm to about 1610 nm.

Respectfully, as amended, the rejection of claims 1, 2, 5-11, 12 and 23 is traversed. In particular, claims 12 and 23 have been cancelled. As such the rejection of claims 12 and 23 are now moot. Further, claim 5 depends from claim 4, which was indicated to contain allowable subject matter. Therefore, it is asserted by Applicant that claim 5 also includes allowable subject matter because of its dependency. Claim 3 has been redrafted in independent form and, therefore, claims 3-5 are now allowable. Likewise, claim 24 has been redrafted in independent form including the limitations of claim 23 and is allowable as indicted by the Examiner.

Regarding claims 1, 2, 6-7, and 9-11 as amended, they are allowable because the prior art does not teach or suggest a dispersion and dispersion slope compensating optical fiber, comprising:

a segmented core and a cladding layer that exhibit a fiber refractive index profile with a dispersion of less than about -50 ps/nm-km at a wavelength of about 1580 nm having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm the fiber refractive index profile has

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

an intermediate segment on an outer periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius; and

an annular ring segment on a periphery of the intermediate segment and having a relative refractive index that is greater than the relative refractive index of the intermediate segment, and a width. This amended claim 1 includes the limitations of former claims 1, 8 and 12.

Bickham '051 only teaches fibers having dispersion between about –12 and –35 ps/nm/km. Bickham '051 does not teach or suggest dispersion and slope compensating fiber having a dispersion more negative than –50 ps/nm/km while exhibiting the dispersion linearity and structure as claimed. Likewise, Li et al does not teach a fiber having the structure as defined in amended claim 1, namely, having a central core segment, a depressed moat segment, an intermediate segment, and an annular ring segment, as claimed. Accordingly, it would not be obvious to make a dispersion compensating fiber including the negative dispersion more negative than –50 ps/nm/km claimed with the structure and linearity claimed absent some teaching or suggestion in the art to do so. As such, claim 1 is allowable and claims 6-7 and 9-11 are allowable for at least those reasons. Claim 8 has been cancelled.

6. New Claim

New claim 42 has been added herein. In particular, claim 42 is directed to a dispersion and dispersion slope compensating optical fiber, comprising:

a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion of less than about -50 ps/nm-km at a wavelength of about 1580 nm having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm.

Claim 42 is allowable because the prior art does not teach or suggest a dispersion and slope compensating fiber having a refractive index profile selected to provide both a dispersion of less than about -50 ps/nm-km at a wavelength of about 1580 nm and dispersion linearity wherein the dispersion plot has a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm.

US 2002/0154877 shows modeled data in Fig. 9 that the Examiner has relied upon to reject claim 1 under 102(e) herein. However, as illustrated in the Affidavit and Attachment "A" submitted herewith, that modeled data in Fig. 9 is incorrect. The assignee herein has caused the dispersion compensating fiber described in Fig. 8 of the '877 to be tested over the range claimed in the present invention from 1550-1610 nm (See Attachment "A"). As can be seen by Attachment "A", that fiber exhibits a maximum deviation of about 30 ps/nm/km over the wavelength range from 1550 nm to 1610 nm. As stated by the inventor who generated Fig. 9, the modeled data shown in Fig. 9 from 1570-1610 nm is incorrect because it is based upon a linear extrapolation of test data in the range of 1528-1570 nm. The inventor of the '877 has since become aware that the data published in Fig. 9 is not representative of the Fig. 8 fiber. In fact, the actual test data for that range (1550-1610) for the Fig. 8 fiber demonstrates that the fiber is highly nonlinear in the range from 1570-1610 nm. Accordingly, the US 2002/0154877 reference does not teach a person of ordinary skill in the art how to produce a fiber, as is claimed in claim 42, having excellent linearity (less than 7 ps/nm/km over 1570-1610 nm) with fairly negative dispersion (less than –50 ps/nm/km at 1580 nm). Thus, claims 42 is believed allowable.

7. Conclusion

Based upon the above amendments, remarks, and papers of record, Applicant believes the pending claims 1-7, 9-11, 13-22, and 24-42 of the above-captioned application are allowable and patentable over the prior art of record. Applicant's respectfully request reconsideration of the pending claims 1-7, 9-11, 13-22, and 24-42 and a prompt Notice of Allowance thereon.

Applicant believes that no extension of time is necessary to make this Response timely. Should Applicant be in error, Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Randall S. Wayland at 607-974-0463.

Respectfully submitted,

CORNING INCORPORATED

Date: May 7, 2003

Randall S. Wayland
Registration No. 36,303
Corning Incorporated
Patent Department
Mail Stop SP-TI-03-1
Corning, NY 14831

CERTIFICATE OF MAILING UNDER 37 C.F.R. § 1.8: I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to Commissioner for Patents, Alexandria, VA 22313-1450 on May 7, 2003
Date of Deposit

Randall S. Wayland
Name of applicant, assignee, or Registered Representative

Signature

May 7, 2003
Date of Signature

VERSION WITH MARKINGS TO SHOW CHANGES MADE

(Amended) 1. A dispersion and dispersion slope compensating optical fiber, comprising:

a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion of less than about -50 ps/nm-km at a wavelength of about 1580 nm having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm the fiber refractive index profile has

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

an intermediate segment on an outer periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius; and

an annular ring segment on a periphery of the intermediate segment and having a relative refractive index that is greater than the relative refractive index of the intermediate segment, and a width.

(Amended) 3. A dispersion and dispersion slope compensating optical fiber, comprising: a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm **[The optical fiber of claim 1]** wherein the refractive index profile is further selected to provide a fundamental mode bend loss of less than or equal to about 0.01 dB/km on a 4 inch diameter hub within a wavelength band from about 1550 nm to about 1610 nm.

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Please cancel claim 8.

(Amended) 9. The optical fiber of claim **[8]** 1, wherein the refractive index profile is further selected to provide a dispersion of less than about -75 ps/nm-km at a wavelength of about 1580 nm.

Please cancel claim 12.

(Amended) 13. A dispersion and dispersion slope compensating optical fiber, comprising: a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm wherein the segmented core comprises:

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

an intermediate segment on an outer periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius; and

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an annular ring segment on a periphery of the intermediate segment and having a relative refractive index that is greater than the relative refractive index of the intermediate segment, and a width and **[The optical fiber of claim 12]** wherein

the relative refractive index percent of the core segment is within a range of from about 1.1% to about 1.7%;

the relative refractive index percent of the moat segment within a range of from about –1.6% to about -0.9%;

the relative refractive index percent of the intermediate segment is within a range of from about -0.1% to about 0.1%;

the relative refractive index percent of the ring segment is within a range of from about 1.0% to about 1.9%;

the outer radius of the central core region is within a range of from about 1.7 μm to about 2.7 μm;

the outer radius of the moat segment is within a range of from about 3.4 μm to about 5.2 μm;

the outer radius of the intermediate segment is within a range of from about 4.9 μm to about 7.5 μm; and

the width of the ring segment is within a range of from about 0.7 μm to about 1.2 μm.

(Amended) 14. The optical fiber of claim **[12]** 13 wherein

the relative refractive index percent of the central core segment is within a range of from about 1.26% to about 1.54%;

the relative refractive index percent of the moat segment is within a range of from about -1.43% to about -1.00%;

the relative refractive index percent of the intermediate segment is within a range of from about -0.10% to about 0.10%;

the relative refractive index percent of the ring segment is within a range of from about 1.40% to about 1.71%;

the outer radius of the core region is within a range of from about 1.98 μm to about 2.42 μm;

the outer radius of the moat segment is within a range of from about 3.87 μm to about 4.73 μm;

the outer radius of the intermediate segment of within a range of from about 5.58 μm to about 6.82 μm; and

the width of the ring segment is within a range of from about 0.86 μm to about 1.05 μm.

(Amended) 15. The optical fiber of claim **[12]** 13 wherein

the relative refractive index percent of the core segment is within a range of from about 1.33% to about 1.47%;

the relative refractive index percent of the moat segment is within a range of from about -1.37% to about -1.23%;

the relative refractive index percent of the intermediate segment is within a range of from about 0.00% to about 0.10%;

the relative refractive index percent of the ring segment is within a range of from about 1.47% to about 1.63%;

the outer radius of the core region is within a range of from about 2.09 μm to about 2.31 μm;

the outer radius of the moat segment is within a range of from about 4.09 μm to about 4.52 μm;

the outer radius of the intermediate segment is within a range of from about 5.89 μm to about 6.51 μm; and

the width of the ring segment is within a range of from about 0.90 μm to about 1.00 μm.

(Amended) 19. **[The optical fiber of claim 1]** A dispersion and dispersion slope compensating optical fiber, comprising:

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a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm wherein the segmented core comprises:

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

a first intermediate segment on a periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius;

an annular ring segment on a periphery of the first intermediate segment and having a relative refractive index that is greater than the relative refractive index of the first intermediate segment and less than the relative refractive index of the central core segment, and a width;

a second intermediate segment on a periphery of the ring segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the moat segment, and an outer radius; and

a gutter segment on a periphery of the second intermediate segment and having a relative refractive index that is less than the relative refractive index of the second intermediate segment and greater than the relative refractive index of the depressed moat segment, and an outer radius **[; and**

an outer clad on the periphery of the gutter segment and having a relative refractive index that is greater than the relative refractive index of the moat segment and less than the relative refractive index of the second intermediate segment] .

(Amended) 20. The optical fiber of claim 19 wherein

the relative refractive index percent of the core segment is within a range of from about 1.2% to about 1.8%;

the relative refractive index percent of the moat segment is within a range of from about -1.2% to about -0.7%;

the relative refractive index percent of the first intermediate segment is within a range of from about -0.1% to about 0.1%;

the relative refractive index percent of the ring segment is within a range of from about 1.1% to about 1.8%;

the relative refractive index percent of the second intermediate segment is within a range of from about -0.1% to about 0.1% [.

the relative refractive index percent of the outer clad segment is within a range of from about -0.2% to about -0.1%] ;

the relative refractive index percent of the gutter segment is within a range of from about [**0.10% to about 0.20%**] <u>–0.13% to about –0.21%</u>;

the outer radius of the core region is within a range of from about 1.7 μm to about 2.5 μm;

the outer radius of the moat segment is within a range of from about 3.7 μm to about 5.5 μm;

the outer radius of the first intermediate segment is within a range of from about 5.1 μm to about 7.9 μm;

the width of the ring segment is within a range of from about 0.8 μm to about 1.3 μm;

the outer radius of the second intermediate segment is within a range of from about 7.7 μm to about 11.5 μm; and

the outer radius of the gutter segment is within a range of from about 11.0 μm to about 13.0 μm.

(Amended) 21. The optical fiber of claim 19 wherein

the relative refractive index percent of the core segment is within a range of from about 1.37% to about 1.67%;

the relative refractive index percent of the moat segment is within a range of from about -1.05% to about -0.86%;

the relative refractive index percent of the first intermediate segment is within a range of from about -0.10% to about 0.10%;

the relative refractive index percent of the ring segment is within a range of from about 1.32% to about 1.62%;

the relative refractive index percent of the second intermediate segment is within a range of from about -0.10% to about 0.10%;

[the relative refractive index of the outer clad is within a range of from about -2.00% to about -1.60%;]

the relative refractive index of the gutter segment is within a range of from about **[0.15% to about 0.19%]** <u>–0.15% to about –0.19%</u>;

the outer radius of the core region is within a range of from about 1.89 μm to about 2.21 μm;

the outer radius of the moat segment is within a range of from about 4.14 μm to about 5.06 μm;

the outer radius of the first intermediate segment is within a range of from about 5.76 μm to about 7.04 μm;

the width of the ring segment is within a range of from about 0.90 μm to about 1.27 μm;

the outer radius of the second intermediate segment is within a range of from about 8.64 μm to about 10.56 μm; and

the outer radius of the gutter segment is within a range of from about 11.30 μm to about 12.30 μm.

(Amended) 22. The optical fiber of claim 19 wherein

the relative refractive index percent of the core segment is within a range of from about 1.44% to about 1.60%;

the relative refractive index percent of the moat segment is within a range of from about -1.00% to about -0.90%;

the relative refractive index percent of the first intermediate segment is within a range of from about -0.10% to about 0.10%;

the relative refractive index percent of the ring segment is within a range of from about 1.40% to about 1.54%;

the relative refractive index percent of the second intermediate segment is within a range of from about 0.00% to about 0.10%;

[the relative refractive index percent of the outer clad is within a range of from about -0.18% to about -0.16%;]

the relative refractive index percent of the gutter segment is within a range of from about **[0.16% to about 0.17%]** <u>–0.16% to about –0.17%</u>;

the outer radius of the core region is within a range of from about 1.95 μm to about 2.11 μm;

the outer radius of the moat segment is within a range of from about 4.37 μm to about 4.83 μm;

the outer radius of the first intermediate segment is within a range of from about 6.08 μm to about 6.72 μm;

the width of the ring segment is within a range of from about 1.05 μm to about 1.21 μm;

the outer radius of the second intermediate segment is within a range of from about 9.12 μm to about 10.08 μm; and

the outer radius of the gutter segment is within a range of from about 11.5 μm to about 12.0 μm.

Please cancel claim 23.

(Amended) 24. **[The communication system of claim 23]** An optical communication system, comprising:

a transmitter adapted to transmit an optical signal;

a transmission fiber in optical communication with the transmitter and adapted to receive the optical signal;

a dispersion compensation fiber in optical communication with the transmission fiber and adapted to receive the optical signal, the dispersion compensation fiber comprising:

a segmented core; and
a cladding layer on the periphery of the core;

wherein a refractive index profile of the dispersion compensating fiber is selected to provide a total dispersion for the dispersion compensating fiber having a maximum deviation of about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm; and

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a receiver in optical communication with the dispersion compensating fiber and adapted to receive the optical signal wherein the compensation fiber comprises:

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

an intermediate segment on a periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius;

an annular ring segment on a periphery of the intermediate segment and having a relative refractive index that is greater than the relative refractive index of the central core segment, and a width; and

[a] the cladding layer on a periphery of the annular ring segment and having a relative refractive index that is less than the relative refractive index of the annular ring segment and greater than the relative refractive index of the depressed moat segment; and wherein

the relative refractive index percent of the core segment is within a range of from about 1.1% to about 1.7%;

the relative refractive index percent of the moat segment is within a range of from about -1.6% to about -0.9%;

the relative refractive index percent of the intermediate segment is within a range of from about -0.1% to about 0.1%;

the relative refractive index percent of the ring segment is within a range of from about 1.0% to about 1.9%;

the outer radius of the core region is within a range of from about 1.7 μm to about 2.7 μm;

the outer radius of the moat segment is within a range of from about 3.4 μm to about 5.2 μm;

the outer radius of the intermediate segment is within a range of from about 4.9 μm to about 7.5 μm; and

the width of the ring segment is within a range of from about 0.7 μm to about 1.2 μm.

(Amended) 25. A dispersion and dispersion slope compensating optical fiber; comprising:

a central core segment having a relative refractive index;

a depressed moat segment on a periphery of the central core segment and having a relative refractive index that is less than the relative refractive index of the central core segment, and an outer radius;

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a first intermediate segment on a periphery of the depressed moat segment and having a relative refractive index that is less than the relative refractive index of the central core segment and greater than the relative refractive index of the depressed moat segment, and an outer radius;

an annular ring segment on a periphery of the first intermediate segment and having a relative refractive index that is greater than the relative refractive index of the first intermediate segment and less than the relative refractive index of the central core segment, and a width;

a second intermediate segment on a periphery of the ring segment and having a relative refractive index that is less than the relative refractive index of the central core and greater than the relative refractive index of the moat segment;

a gutter segment on a periphery of the second intermediate segment and having a relative refractive index that is less than the relative refractive index of the second intermediate segment and greater than the relative refractive index of the depressed moat segment, and an outer radius; and

a cladding layer on a periphery of the gutter segment and having a relative refractive index that is less than the relative refractive index of the annular ring segment and greater than the relative refractive index of the depressed moat segment; and wherein

the relative refractive index percent of the core segment is within a range of from about 1.2% to about 1.8%;

the relative refractive index percent of the moat segment is within a range of from about -1.2% to about -0.7%;

the relative refractive index percent of the first intermediate segment is within a range of from about -0.1% to about 0.1%;

the relative refractive index percent of the ring segment is within a range of from about 1.1% to about 1.8%;

the relative refractive index percent of the second intermediate segment is within a range of from about -0.1% about 0.1%;

the relative refractive index percent of the gutter segment is within a range of from about **[-0.1% to about -0.2%]** <u>-0.13% to about -.21%;</u>

[the relative refractive index percent of the gutter segment is within a range of from about 0.1% to about 0.2%]

the outer radius of the core region is within a range of from about 1.7 μm to about 2.5 μm;

the outer radius of the moat segment is within a range of from about 3.7 μm to about 5.5 μm;

the outer radius of the first intermediate segment is within a range of from about 5.1 μm to about 7.9 μm;

the width of the ring segment is within a range of from about 0.9 μm to about 1.4 μm;

the outer radius of the second intermediate segment is within a range of from about 7.7 μm to about 11.5μm; and

the outer radius of the gutter segment is within a range of from about 11.0 μm to about 13.0 μm.

Please add new claim 42.

42. A dispersion and dispersion slope compensating optical fiber, comprising:

a segmented core and a cladding layer on the periphery of the core wherein the segmented core and the cladding layer exhibit a fiber refractive index profile that is selected to provide a dispersion of less than about -50 ps/nm-km at a wavelength of about 1580 nm having a maximum deviation of less than about 7 ps/nm-km within a wavelength band of from about 1550 nm to about 1610 nm.